

COMBUSTION TOOL HAVING COLLAPSIBLE VOLUME

CLAIMS:

1. A gas combustion powered apparatus, comprising:
a piston chamber housing a driveable piston;
a combustion chamber having a generally flat wall assembly and a cup-shaped wall defining at least one combustion volume therebetween, said cup-shaped wall moveable in relation to said piston chamber and having a generally flat portion opposing, and generally parallel to, said generally flat wall assembly;
an ignition source in operable relationship to said at least one combustion volume, to ignite a combustible gas within said at least one combustion volume;
said piston forming at least a portion of said generally flat wall assembly when said piston is in an undriven state, and
said driveable piston returnable to said undriven state by vacuum pressure within said combustion chamber.
2. The apparatus of claim 1, wherein said moveable cup-shaped wall has a fully closed position and a fully opened position, said at least one combustion volume being reduced to approximately zero in said fully closed position.

3. The apparatus of claim 2, wherein at least a second portion of said generally flat portion of said cup-shaped wall contacts at least a portion of said generally flat wall assembly when in said fully closed position.

4. The apparatus of claim 2, wherein a movement of said moveable cup-shaped wall from said fully closed position to said fully opened position generates an air turbulence within said at least one combustion volume.

5. The apparatus of claim 2, wherein an area of said generally flat portion of said cup-shaped wall is approximately equal to an area of said generally flat wall assembly.

6. The apparatus of claim 2, further comprising:
a moveable work contact element for engaging a workpiece; and
said movement of said moveable cup-shaped wall is operably linked to a movement of said work contact element.

7. The apparatus of claim 6, wherein said cup-shaped wall is fixed to move directly with said movement of said work contact element.

8. The apparatus of claim 7, wherein turbulence is created in a vicinity of said ignition source by an injected high-speed fuel jet.

9. The apparatus of claim 8, wherein said fuel jet is injected through a fuel port located on a wall of said combustion chamber, said fuel port and said ignition source being generally configured in a plane of said generally flat wall assembly.

10. The apparatus of claim 9, wherein said fuel port and said ignition source are located at opposing positions along said flat wall assembly, with respect to a center of said flat wall assembly.

11. The apparatus of claim 10, wherein said fuel jet is injected into said combustion chamber in a direction toward a center of said generally flat portion of said cup-shaped wall opposite to said center of said flat wall assembly.

12. The apparatus of claim 6, wherein said cup-shaped wall is operably connected to said work contact element by a spring tension.

13. The apparatus of claim 12, further comprising:
a first moveable pawl capable of locking said cup-shaped wall in said fully closed position;

said movement of said work contact element creating a tension in said spring; and

activation of a trigger causes said first pawl to move to unlock said cup-shaped wall, thereby allowing said spring tension to move said cup-shaped wall to said fully opened position.

14. The apparatus of claim 13, further comprising a second pawl capable of locking said cup-shaped wall in said fully opened position.

15. The apparatus of claim 2, wherein said cup-shaped wall forms a portion of said combustion chamber structure, and said combustion chamber opens when said combustion volume is in said fully open position and closes when said combustion volume is in said fully closed position.

16. The apparatus of claim 2, wherein said cup-shaped wall is a moveable plug located within an interior of said combustion chamber.

17. The apparatus of claim 16, wherein an outer periphery of said moveable plug generally conforms to an inner wall of said combustion chamber.

18. The apparatus of claim 17, wherein a position of said moveable plug within said combustion chamber defines a single mixing volume in

said combustion chamber when in said fully closed position, and defines at least a first combustion volume and a second combustion volume within said combustion chamber when in said fully opened position.

19. The apparatus of claim 18, wherein said first combustion volume is represented by V1, said second combustion volume is represented by V2, said mixing volume is represented by Vm, and a formula is generally satisfied when

$$V_m(\text{fully closed position}) = V_m(\text{not fully closed position}) + V1 + V2.$$

20. The apparatus of claim 18, wherein said second combustion volume is substantially equal to a volume within said combustion chamber displaced by a location within said combustion chamber of at least a portion of said piston chamber.

21. The apparatus of claim 20, wherein said first combustion volume is annular, and said second combustion volume is cylindrical.

22. The apparatus of claim 21, wherein an inner diameter of said annular first combustion volume is substantially equal to an outer diameter of said cylindrical second combustion volume.

23. The apparatus of claim 18, further comprising:

a fuel port located on said generally flat portion of said moveable plug, and allowing communication from said mixing volume into said second combustion volume when not in said fully closed position; and

a combustion port located on a ring-shaped portion of said moveable plug, and allowing communication between said first and second combustion volumes when not in said fully closed position.

24. The apparatus of claim 23, wherein when not in said fully opened position, airflow is allowable between said first and second combustion volumes through an opening between said combustion volumes which is different from said combustion port, and airflow is blocked between said first combustion volume and said mixing volume.

25. The apparatus of claim 23, wherein when not in said fully opened position, airflow is allowable between said first and second combustion volumes through an opening between said combustion volumes which is different from said combustion port, and airflow is allowable between said first combustion

volume and said mixing volume through an opening between said mixing and first combustion volumes.

26. The apparatus of claim 23, wherein said fuel port and said combustion port are the only airflow communication means between the mixing, first combustion, and second combustion volumes.

27. The apparatus of claim 16, further comprising:
a moveable work contact element for engaging a workpiece; and
a stem portion attached to said moveable plug and extending through an opening in said combustion chamber for operable linkage with said work contact element.

28. A gas combustion-powered apparatus, comprising:
a combustion chamber;
said combustion chamber including a first wall and a second wall moveable with respect to said first wall between a first, collapsed position and a second, expanded position defining a volume between said first and second walls;
an ignition source in operable relationship to said combustion chamber for causing an ignition of a combustible gas within said volume; and

a fueling apparatus constructed and arranged for injecting a pressurized fuel into said volume prior to said ignition and at sufficient pressure to create turbulence in said volume without mechanical assistance.